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WIRELESS VIDEO SURVEILLANCE SYSTEM

This invention relates to an apparatus and method for wireless video surveillance and communication. In particular, it relates to an apparatus and method employing commercially available, hand-held

5   portable device, such as personal information managers and personal digital assistants.

BACKGROUND TO THE INVENTION

The use of personal digital assistants (PDA's), such as the

10   3COM Palm Pilot®, is becoming very widespread. Functionality of PDA's varies between manufacturers but all include a liquid crystal display, an input device, memory and a processor unit. Various improvements are constantly being made to increase available memory, improve processing power and extend software applications.

15   Recently, PDA manufacturers have released devices having colour liquid crystal displays and wireless communication capability. This innovation has been driven by a desire to provide PDA's with internet access for web surfing and e-mail. Similar market pressures are driving the integration of processing capability into mobile phones

20   to facility direct web access for the same purposes.

It is also known to integrate PDA's with mobile phones to provide an integrated system giving full voice and date transfer facilities. One such system is described in United States patent number 5625673, assigned to Lucent Technologies Inc. The patent describes a PDA that

25   includes means for cordless connection to specialised accessories, such as a cellular telephone and a modem.

The capabilities of PDA's have not been extended for application in the video surveillance area. Existing surveillance systems, such as

house security systems, do not normally offer a video surveillance capability. When such a capability is provided, it is usually linked to a base station that provides remote manual surveillance.

5   The majority of existing surveillance systems utilise a local processing centre that packets data for transmittal to the base station. Transmittal may be by dedicated land-line or may be via a dial-up connection.

OBJECT OF THE INVENTION

10   It is an object of the invention to provide an apparatus and method for wireless video surveillance.

SUMMARY OF THE INVENTION

In one form, although it need not be the only, or indeed the
15   broadest, form the invention resides in a wireless video surveillance system comprising:

a portable monitor device including wireless communication means;

one or more video recording means for recording video images of a scene; and

20   at least one interface module converting said video images to transmittable data, said interface module incorporating wireless communication means for transmission of said transmittable data from said at least one interface module to said portable monitor device, said potable monitor device incorporating means for receiving and
25   displaying said transmittable data.

In preference, the portable monitor device is a personal digital

assistant or similar hand-held processing unit incorporating processor means, memory means and video display means. The portable monitor device suitably also includes input means.

5 The video recording means may be a digital camera or may be commercially available VHS video camera, such as a Camcorder®.

Suitably, the interface module includes input means for receiving video signals from said video recording means. A suitable input port is a USB port for digital video input. If an analog video recording means is employed, the input means suitably includes a video input port and

10 analog to digital conversion means.

The interface module preferably also includes digital signal processing means, transmission buffer and signal transmission means.

The digital signal processing means of the interface module is suitably programmed with video and audio compression algorithms.

15 Corresponding audio and video decompression algorithms are suitably programmed in the processor means of the portable monitor device.

In a further form, the invention resides in a method of providing wireless video surveillance including the steps of:

recording a video image of a scene;

20 processing the recorded image to form data for wireless transmission;

transmitting the data to a personal digital assistant; and

processing the data to display the image on the personal digital assistant.

Processing the recorded image preferably includes the steps of

25 compressing the image at the interface means and decompressing the image at the personal digital assistant.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention are described with reference to the following figures in which:

FIG 1 is a block diagram of the invention;

FIG 2 is a block diagram of the interface module;

FIG 3 is a block diagram of the portable video monitor;

FIG 4 is a block diagram of an embodiment of the invention; and

FIG 5 is a block diagram of a further embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG 1 there is shown a block diagram of a wireless video surveillance system consisting of a video recording means 1, in signal connection with an interface module 2 which is in signal connection with an antenna 3. Signals 4 are transmitted from the antenna 3 to an antenna 5 associated with a portable monitor device 6 which is a personal digital assistant or portable personal computer. Video images from the recorder 1 are displayed on a display 7 of the monitor 6.

In the preferred embodiment the video recording means 1 is a commercially available VHS video recorder having standard video and audio outputs.

The interface means 2 is shown in greater detail in FIG 2. Video and audio input from the recorder 1 is input through port 8 and converted to digital form in analogue to digital converter 9. The output from the ADC is buffered in dual frame buffer 10 for input to a digital signal processor 11.

In an alternate embodiment a digital camera could be employed as the video recording means 1. In this case, the digital output from the camera can be input directly to the dual frame buffer 10 through USB port 12.

5   The digital signals are processed for transmission in the digital signal processing chip 11. The required processing will depend on the transmission network being employed and known signal processing and compression algorithms can be used. Random access memory 13 is provided for on-board storage of data for signal processing.

10   Although a software implementation of the signal processing has been described, a hardware implementation is also suitable. In one embodiment, signal processing can be performed using an ASIC (Application specific integrated circuit)/FPGA (Field programming gate away) solution. Alternatively, an ASIC (Applicant specific integrated

15   circuit) front end can be used with a programmable DSP backend. The invention is not limited to any one of these possible solutions.

If a DSP solution is used, the DSP is programmed with available compression software. The invention is not limited to any particular software solution, although the inventor has 8-bit and 24-bit coding

20   methods are suitable. Different coding methods may be more suitable for certain colour video displays available in the wide variety of PDA's currently on the market. New coding solutions are regularly becoming available and the inventor recognises that the invention may employ new algorithms in the future.

25   The selected video compression method will implement three basic stages. The first stage performs temporal decorrelation, also termed interframe coding. This process consists of an optional block based motion compensation step followed by temporal prediction and replenishment. This determines which portions of the image frame have

30   changed and selectively sends update information to reproduce the

changes. This eliminates the need to retransmit the entire image each time when there have not been extensive change over time. A side product of this stage is that the output can be used to trigger an alarm to be sent to the video monitor when any motion is detected.

5 Depending on the coding method used, quantisation may be performed at this point.

The next stage decomposes the resultant interframe images from the previous step into basic coding units. The nature of these units varies depending on the coding method being used. In the classic

10 transform based coding methods these coding units are 2D blocks of spatial frequency coefficients. These may equally be image primitives of another form such as run length vectors or uniform colour blocks. The values of the coding units are then substantially quantised to eliminate unwanted information.

15 The final stage involves reordering the symbols or values to be coded so as to enhance compressability followed by some form of variable length or statistically based coding to efficiently create a compact bit stream for each frame. This final stage is alway lossless. This resulting bit stream is then appropriately packaged in a frame

20 packet for insertion into the output data stream.

Audio coding will also be implemented in the DSP stage. In one embodiment a standard ADPCM compression method is used. GSM speech coding will also be useful for use in conjunction with the integrated PDA/mobile phone scenario.

25 For each frame of video compressed and transmitted an audio frame of equivalent time duration will also be compressed and sent. In this way, excepting the event of system control frames in the date stream, the predominant structure of the transmitted data stream will consist of alternating video and audio frames in an interleaved manner.

The processed data is buffered in transmission buffer 14 before being transmitted by transmission module 15. The transmission module 15 can be any suitable wireless transmission system. Three alternative embodiments are discussed in detail below.

5 The important elements of the portable monitor device are shown in greater detail in Fig 3. The monitor includes a receiver module 16 for receiving the data transmitted by the interface means 2. The monitor is loaded with software for processing the received signals in the CPU 17. On-board RAM 18 stores data and parameters for the
10 signal processing. The processed image is displayed on the liquid crystal display 7.

The receiver module 16 is selected to match the transmission module 15. A number of alternatives are discussed below.

Fig 4 shows an embodiment in which a VHS video camera 19 is
15 connected to an interface module 20 that provides a low power signal to an antenna 21 for a local area network. This embodiment may have a typical range of 150m for signals 22. The signals 22 are typically radio frequency signals although infrared signals may also be suitable in point to point applications.

20 The monitor device 23 is a personal digital assistant with a wireless network card 24 and antenna 25 to receive signals 22. The wireless network card 24 interfaces to the personal digital assistant through a PCMCIA slot or compact flash port.

The embodiment of Fig 4 supports simplex video and full duplex
25 audio communication. It is most suitable for implementation in domestic applications, for child minding and security. For example, a parent may use the configuration to monitor a child sleeping in a separate room. Another application is to monitor an entryway. The full duplex audio allows communication with a person seeking entrance while the

simplex video channel allows the person to be viewed.

The primary advantage of the embodiment of Fig 4 is that the video monitor is portable and therefore the user can move freely around the home. It will be appreciated that this is a significant
5   improvement over known prior art security and child-minding systems.

For longer range applications the embodiment of Fig 5 is preferable. A digital video camera 26 provides audio and video input to the interface module 27. The transmission module 28 is a standard telephone interface for transmitting signals 29 across a CDMA or GSM
10   cellular phone network. The monitor device comprises a personal digital assistant 30 with a modem 31 connected to a phone 32. The PDA is programmed with algorithms to process the received data for display.

In a variation of this embodiment the PDA and phone are integrated into a single device. Suitable devices have recently become
15   commercially available.

As mentioned above, the embodiments provide simplex video and duplex audio communication. The second embodiment provides duplex audio via the phone. Duplex audio communication for the first embodiment may be provided by built-in microphones provided in some
20   PDA's or by an external microphone coupled to the network card.

The above embodiments have been extended by providing local storage of audio and video footage which can be viewed on command from the monitor. Movement detection functionality has also been provided in the interface module so that an alarm can be provided if
25   movement is detected in the viewed scene. Combined movement detection and local video storage are particularly useful for the second embodiment to facilitate dial-up operation.

In one method of operation, the interface module is configured to detect movement in the field of view. When movement is detected the

video footage is stored locally and a call is placed to the video monitor. The phone touch tones or the duplex audio channel may then be used to send tone commands to trigger replay of the stored video footage. The great advantage of this systems is that security is provided without

5   the need of a fixed base station with permanent monitoring.

It will be appreciated that multiple cameras and interface modules can be programmed to a single or multiple video monitors. It would therefore be possible for a number of security guards to carry personal digital assistants providing mobile monitoring of multiple

10   camera installations.

Although the above embodiments only offer simplex video communication, it will be appreciated that the invention is not limited to this implementation. The provision of simplex rather than duplex video is due to the processing power available in commercial PDA's.

15   Improved processing power will allow the PDA's to run software that permits compression and transmission of video images. A video recording means is added to the portable monitor device for duplex video transmission.

Throughout the specification the aim has been to describe the

20   invention without limiting the invention to any specific combination of features.

DATED This Twenty-Second day of April 1999

On behalf of GRIFFITH UNIVERSITY

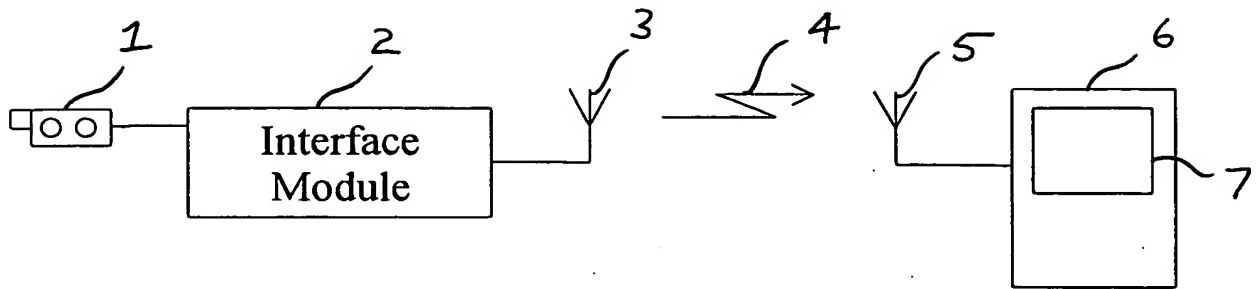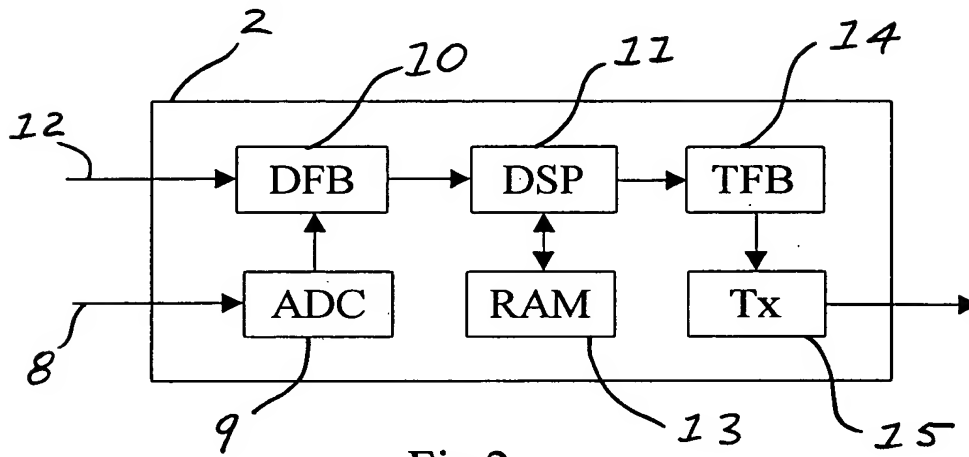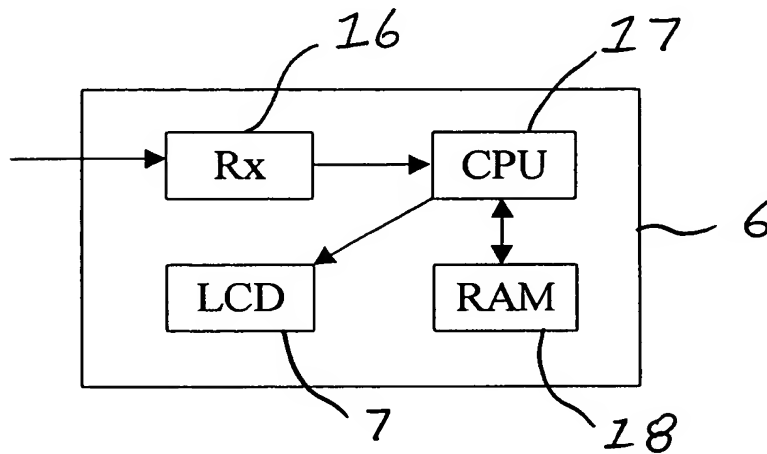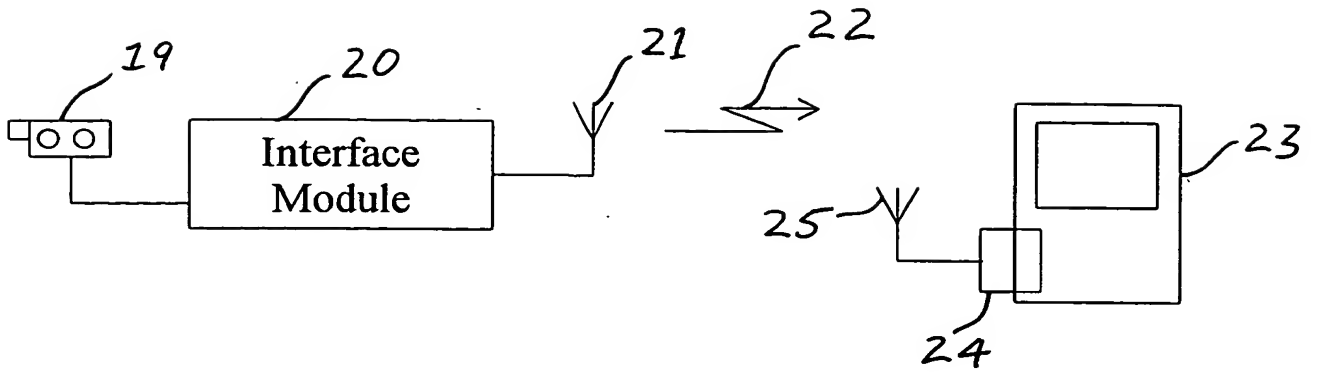25   By Their Patent Attorneys

FISHER ADAMS KELLY

1   2   3   4   5   6

Interface
Module

7

Fig 1

2   10   11   14

12

DFB → DSP → TFB

ADC   RAM   Tx

8

9   13   15

Fig 2

16   17

Rx → CPU

LCD   RAM

6

7   18

Fig 3

19 20 21 22

Interface
Module

23

25

24

Fig 4

26 27 29 32 30

Interface
Module

28

31

Fig 5